Individual and situational predictors of snacking in overweight and obese adults

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I declare that this report is my own original work and that contributions of others have been duly acknowledged.

Signature:…….. ***Date:……..***

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Abstract

The aim of this research was to examine the role of cues in guiding snacking intake in overweight and obese adults. Previous research suggests that internal cues (like negative affect) in conjunction with social (seeing others eating) and external cues (having food available and being in areas of high food outlet density) can predict snacking, but these have rarely been examined in conjunction and never in an overweight/obese sample. Ecological Momentary Assessment (EMA) was used to collect data from 51 individuals classed as overweight or obese. For 14 days, participants recorded their food and drink intake and responded to questions assessing their mood, and contextual and situational factors. Results support the role of stimulus-control in snacking, with both internal and external influences. Availability of food and social factors were among the strongest predictors of snacking, as was the experience of negative affect, which supports the notion of comfort eating. BMI however, was not found to moderate these effects, nor was it related to snacking frequency, indicating that BMI in itself is not directly related to stimulus-control eating, rather it is an outcome of, rather than a predictor for, the influence of cues on dietary intake.

Obesity is defined as having excess fat stored in adipose tissue to the extent that it becomes hazardous to ones health (World Health Organisation, 2000). The number of individuals classified as either overweight (Body Mass Index; BMI >= 25 kg/m^2) or obese (BMI >= 30 kg/m^2) has reached levels of epidemic proportion across many western countries (Lupton, 2013). In Australia, this number has risen from 44% of adults classed as overweight or obese in in 1989, to almost 63% in 2011-2012 (National Health Performance Authority, 2013; Australian Bureau of Statistics; ABS, 2013). This was comprised of 27.5% of individuals falling into the obese category and 35.3% the overweight category (ABS, 2013). Overweight and obesity cost the Australian health care system $21 billion annually (Colagiuri *et al.,* 2010). Excess weight also carries significant health costs to the individual, such as increased risk of developing conditions such as diabetes, high blood pressure, infertility and depression (Tanamas *et al.,* 2013). The widespread nature of overweight and obesity makes research into the factors that contribute to the development of obesity a necessity. Findings could then form the basis of interventions to support weight management.

At the most simplistic level, weight-gain is caused by an energy-imbalance, whereby the energy intake from food and drink exceeds an individual's energy-expenditure from exercise (i.e., eating beyond ones physiological requirements; Crossley, 2004). There are many different reasons as to why people eat. This research will focus on some internal and external cues guiding food intake. Firstly I will examine how hunger drives food intake, and then consider other individual factors likely to cue eating. Various social influences will be explored, as well as environmental cues encouraging food consumption.

Hunger and eating

Hunger is perhaps the most instinctual reason as to why people eat. However, it is not that simple and there are many different types of hunger that encourage eating, such as homeostatic, hedonic and cued hunger (Stroebe, Papies & Aarts, 2008). Each hunger type stimulates the same hormonal and neurological pathways that signal an individual to eat, however each have different underlying causes. Homeostatic hunger is derived from a physiological lack of food (Stroeb *et al.,* 2008), whereas both cued and hedonic hungers are derived from other factors that encourage food consumption. In the case of hedonic hunger, the anticipated pleasure one will get from eating drives an individual to eat (Lowe & Butryn, 2007), whereas cued hunger is initiated by broader factors encouraging eating (Hofmann, Van Koningsbruggen, Stroebe, Ramanathan & Aarts, 2010). If individuals simply ate because their homeostatic mechanisms demanded food, there would not be such a high prevalence of overweight and obesity (Saper, Chou & Elmquist, 2002). However, the high rates of overweight and obesity demonstrate this is not the case, suggesting people are likely to eat for reasons other than being physiologically hungry.

Initiated by cues, cued hunger is a significant driver for food consumption. Cued hunger demonstrates stimulus-controlled eating, whereby individuals eat because they are cued to eat, rather than because they are physiologically hungry (Weingarten, 1985). These eating cues can be internally or externally motivated, but do not relate to the biological mechanisms guiding eating practices. Internal eating cues may involve the influence of different moods on eating behaviours (Pollard, Kirk & Cade, 2002). External eating cues relate to the elements of the environment that trigger food intake such as the sight or smell or foods (Wansink, 2004).

Environmental food cues, such as exposure to palatable food direct individuals attention towards such foods, thereby stimulating hunger expectancies and increasing the likelihood of their consumption (Hofman *et al.*, 2010; Rogers & Hill, 1989). The food intake driven by cued responsiveness results in difficulties in losing weight and eating in excess of homeostatic needs likely (Jackson *et al.,* 2003; Stroebe *et al.,* 2008).

Snacking

Snacks are generally consumed in response to cued hunger, whereas main meals are normally consumed in response to physiological hunger requirements (Johnson & Anderson, 2010). Despite this, individuals are generally unaware of the cues triggering their snacking (Verhoeven, Adriaanse, de Vet, Fennis & de Ridder, 2014). Consequently, monitoring snacking intake in conjunction with everyday contexts cues will likely lead to a better-developed understanding of the common triggers underlying snacking intake.

Although there is no agreed upon definition for snacking (Johnson & Anderson, 2010), for the purposes of this research, snacking refers to any food and drink consumption that occurs between main meals (of breakfast in the morning, lunch around midday and dinner in the evening; Verhoeven, Adriaanse, Evers & de Ridder, 2012). In the literature, snacks are referred to as being discretionary, as they do not provide essential nutrients, but in Australia contribute an average of approximately 35% of an individual's total daily energy intake (ABS, 2014). Typically, snack foods are energy-dense and are high in sugar, salt and/ or saturated fats (National Health and Medical Research Council, 2013).

Overweight and obese individuals tend to consume different snacks compared to their lower-weight counterparts. Often this includes foods such as desserts (cakes), salty foods (chips), or beverages that are typically sweet and milky (tea, coffee or hot chocolate with sugar). Conversely, individuals with normal to lower weights tend to choose snacks derived from baked goods, fruit, dairy products and sweets (Forslund, Torgerson, Sjöström & Lindroos, 2005). It is unclear whether it is the frequency, the quantity, or the quality of the snacks themselves that is driving overweight and obesity (Johnson & Anderson, 2010; Kant, 2000; Zizza, Siega-Riz & Popkin, 2001). Regardless, energy intake increases with snacking frequency, and it is the excess energy that leads individuals to gain weight (Crossley, 2004; Forslund *et al.,* 2005).

Individual cues guiding eating

Individual cues influence when and how much individuals eat. The influence of mood has been an area of interest across numerous nutritional research studies. Negative mood states are strong triggers for eating, particularly the consumption of comfort foods and snacks (Loxton, Dawe, & Cahill, 2011; Wansink, Cheney & Chan, 2003). Interestingly, there are sex-based variations in food consumption patterns. For men, comfort foods often include warm meals such as steak, casseroles and soup, whereas women turn to foods that are more commonly viewed as snacks, such as chocolate and ice cream (Wansink *et al.,* 2003). Often foods with high fat and/ or sugar content are chosen as comfort foods because their properties (of sugar and fat) target the brain in a similar manner to opiates, rendering food a cheap and effective means of short-term stress-relief for many individuals (Groesz *et al.,* 2012). Research suggests there is a relationship between caloric intake and mood

improvement, whereby the more calories consumed, the greater the improvement in mood (Dingemans, Martijn, Jansen & van Furth, 2009). However, it is likely that this only occurs within the first few minutes of eating (Bongers, Jansen, Havermans, Roefs & Nederkoorn, 2013). Nevertheless, it demonstrates that mood can serve as a cue for eating certain foods (Bongers *et al.*, 2013; Loxton *et al.*, 2011). Further exploration of the relationship between emotion and food consumption will allow for greater understanding of the mechanisms that determine how individual cues such as mood influence food intake.

Related to comfort eating is the notion of stress eating, in which individuals overeat in an attempt to feel better (Sproesser, Schupp & Renner, 2014). Stress eating often means the consumption of 'mood altering foods' that are highly palatable and generally non-nutritious, a common example of such food is chocolate (Groesz *et al.*, 2012; Parker, Parker & Brotchie, 2006). During stressful times individuals often increase their consumption of high fat and sugary snack foods whilst simultaneously decreasing their main meal and vegetable intake (O'Connor, Jones, Conner, McMillan & Ferguson, 2008). The vulnerability of an individual to stress-eat or to eat to improve their mood is subject to great individual difference (O'Connor *et al.*, 2008). However, in general, this type of eating is more strongly associated with individuals who are overweight or obese compared to those with lower BMI ranges (Dressler & Smith, 2013). Targeting individuals' stress responses can result in improved food choices (O'Connor, Armitage & Ferguson, 2015). Therefore, examining the role of stress in the relationship between food and emotion is central in understanding how emotions can serve as cues to eating.

As described in the preceding paragraphs, often emotions play a significant role in individuals' food choices. In the long-term, this is likely to lead to overeating

and weight-gain (Dressler & Smith, 2013). Moreover, it may lead the individual to develop cravings for particular foods. Cravings are developed by repeated consumption of highly palatable foods, particularly when such foods serve to enhance one's mood. Neurological studies suggest that, over time obese individuals experience neurophysiological reactions to the properties of food that are consistent with the reactions of drug experiences among drug dependent individuals (Blumenthal & Gold, 2010). This sensitivity to favouring palatable foods may be detrimental to ones' health, for they typically involve foods high in fat, sugar and/ or salt, for example, chips, chocolate and ice cream (Bongers *et al.*, 2013; Dressler & Smith, 2013). All of these foods are likely to lead to weight gain if consumed often or in large quantities. Generally, food cravings are considered to be the affected individual's problem, however, preference for these foods may be learnt, rendering evaluation of possible social and environmental cues shaping food preference necessary (Hepworth, Mogg, Brignell & Bradley, 2010).

Effect of social cues on shaping food consumption

Eating patterns change during social encounters, especially when people encounter other people eating. Eating and drinking are often integral parts of socializing (Renner, Sproesser, Strohbach & Schupp, 2012). Not only can simply being in a social situation influence eating, but the individuals one is dining with can also influence the amount of food consumed. The people one are surrounded by set a norm for appropriate food and drink intake (Vartanian, Sokol, Herman & Polivy, 2013). This then guides an individual's intake to match the norm set by their peers (Burger *et al.*, 2010; Jackson, Cooper, Mintz & Albino, 2003). Therefore, social eating norms specify socially acceptable consumption for given situations (Wang,

Xue, Chen & Igusa, 2014). Consequently, when an eating companion eats more, so does the individual. Similarly, they also tend to eat less when their companion eats less (Vartanian *et al.,* 2013). Some theorists conclude that eating norms allow individuals to consume as much food as possible without appearing to their companions as overeating (Burger *et al.,* 2010; McFerran, Dahl, Fitzsimons & Morales, 2010; Leone, Pliner & Herman, 2007).

Theorists such as Herman, Roth and Polivy (2003) summarise the social influence of eating as occurring in three distinct ways: as social facilitation, modeling, or as an impression management. A social facilitation effect is observed when individuals consume more when food in the presence of others in comparison to when they are alone. De Castro (1994) reports that up to 44% more food is consumed during meals when there are others present compared to when individuals eat alone. There are a multitude of reasons for the social influence on eating, such as, the increased time taken to consume a meal due to the pressure to maintain social exchanges during the course of the meal. Additionally, interacting with others during the meal serves as a distraction from ones satiety cues, thereby allowing food to be consumed beyond one's physiological needs. Furthermore, dining with others prolongs eating duration, thus also permitting for increased food and drink intake. When dining with others, one is more likely to consume alcohol than they would if they were eating alone. Alcohol can act as to mask inhibitions regarding food consumption; allowing individuals to eat more when they are with others (Herman *et al.,* 2003).

Another social cue influencing food intake relates to modelling. Modelling occurs when individuals base their food consumption on what others are doing; consuming more when others consume more, less when others consume less etc.

(Herman *et al.*, 2003). An example of this is when individuals order dessert despite reporting to feel full, simply because others on their table ordered dessert. Herman *et al.* report that modelling occurs regardless of the individuals' BMI and whether or not they are on a diet. They suggest that modelling may be a result of individuals attempting to gain social approval, rather than an attempt to use others to guide appropriate intake levels (Herman *et al.*, 2003).

Impression management is the final type of social influences that effects eating. It occurs when individuals eat less when they perceive others may be evaluating them (Herman *et al.*, 2003). Impression management is particularly relevant when an individual is eating alone but is in the presence of others. Food intake level in this situation is theorized to convey a desired impression towards others or possible observers. The desired impression management message surrounds one being disciplined and in control of their eating. The downfall of this theory is that in reality individuals are not usually aware of their intention to form an impression in this regard (Herman *et al.*, 2003; Mollen, Rimal, Ruiter & Kok, 2013). Despite the lack of evidence explaining the underlying reasons perpetuating impression management, it shows that being in the presence of others does not always increase food consumption; it can limit food intake depending on who is around. Further evidence examining how the presence of others cues eating (or non-eating/ eating restrictions), is required.

Beyond just being with others versus being alone, the nature of the social contact such as which person one interacts with has varying effects on dietary behaviour. When eating with friends and family, food intake is generally increased because individuals feel more relaxed than they do when eating in the presence of co-workers or other companions (de Castro, 1994). The effect of being more relaxed

when eating enables the individual to be less guided by social cues and be more autonomous with their food choice and eating practices.

Despite mixed results of how social encounters cue food intake, it appears as though being around others creates a set of social norms which then serve as cues in guiding when eating should stop (Herman *et al.,* 2003). At a minimum, it appears as though social norms guide eating behaviours insomuch as they serve as an inhibitory function, indicating a time where food consumption is becoming excessive (Leone *et al.,* 2007). The role of various types of social company needs to be further explored to enhance the theoretical understanding of surrounding social cues that shape eating practices.

Effect of the environment on eating

As previous sections have demonstrated, overweight and obesity is influenced by a multitude of factors including individual and social elements. However, as population rates of these conditions have risen so rapidly over the past 30 years (ABS, 2013), it is suggested that overweight and obesity is likely to be associated with some sort of environmental change (Wakefield, 2004). This section will examine various environmental cues that shape individuals lifestyles and eating patterns, which could then explain the current overweight and obesity trends.

Firstly, the environment shapes behaviour resulting in weight-gain. Like many western countries, Australia has a high prevalence of overweight and obesity, which has led to Australia being dubbed as an 'obesogenic environment' (Hill & Peters, 1998; Wakefield, 2004). This means Australia has an environmental landscape that encourages overweight and obesity (Rosengren & Lissner, 2008). This is achieved twofold: firstly, through the promotion of convenient, inexpensive and

palatable foods that are typically unhealthy, and secondly, through the promotion of a sedentary lifestyle (Hill & Peters, 1998). In many populated areas, the opportunity for physical activity is undermined by the abundance of opportunity to utilize public transport and cars to move around cities (Giles-Corta, Maccintyre, Clarkson, Pikora & Donovan, 2003). Aspects of the environment can thereby shape the behaviour of individuals, which can (and often does) lead them towards developing overweight and obesity.

Weight-related trends can be observed across various environments. For example, individuals with higher BMIs tend to be localized in certain communities and environments (ABS, 2013). In particular, there is a relationship between higher density of fast-food restaurants and the residents of those areas having higher BMIs (Li, Harmer, Cardinal, Bosworth & Johnson-Shelton, 2009). However, it is possible this may be a result of low socioeconomic status, which is also linked to higher rates of overweight and obesity as well as greater density of fast-food restaurants (ABS, 2013; Reidpath, Burns, Garrard, Mahoney & Townsend, 2002). Li *et al.* (2009) report residents of neighbourhood with high densities of fast-food outlets are almost twice as likely to be obese than those who lived in areas with fewer fast-food restaurants. Additionally, areas with greater numbers of supermarkets tend to have less overweight and obesity prevalence (Morland, Diez Roux & Wing, 2006). This is likely to be because of supermarkets stocking a wide range of fresh foods, low fat and other healthy options, rendering their products healthier choices than foods sold at fast food outlets (Thornton & Kavanagh, 2012). Together, these findings suggest that the accessibility of food stores effect how food is brought and consumed. The environment consists of many cues that encourage individuals to consume foods that are readily available and easily accessible.

The consumer food environment reflects the availability, prices, promotion and nutritional quality of available food products, all of which cue individuals to buy and consume certain foods (Ni Mhurchu *et al.,* 2013). Whilst research examining the consumer food environment is in its early stages, it appears as though there is a link between the consumer food environment and dietary outcomes, whereby food availability influences consumer practices and subsequently dietary behaviours (Ni Mhurchu *et al.,* 2013).

A related environmental cue that influences consumer practices surrounds the techniques used by restaurants to encourage customers to overeat. Typically this involves serving large portion sizes and presenting food in a highly appealing manner, which tempts customers to be swayed by their hedonic hunger cueing them to eat (Cohen, 2008; Wansink, 2004). Since the 1970's- 1980's restaurants have dramatically increased their portion sizes, which has led some researchers to suggest this has had implications on the rising rates of overweight and obesity (Young & Nestle, 2002). Similarly, the size of a plate food is presented on can impact the amount of food consumed. Individuals base their serving size off the size of a plate; filling it with approximately 70% food. Therefore when presented with larger plates individuals tend to serve, and subsequently eat, more than they would when it is served on a smaller plate (Wansink & van Ittersum, 2013). Together, these findings suggest environmental information can cue an individual to eat, and in some cases continue to eat, even when the eating extends beyond ones physical requirements.

Measuring food consumption

Most studies that have examined the relationship between the environment and eating have used retrospective reporting, rather than reporting moment-to-

moment environmental exposures (Shiffman, Stone & Hufford, 2008). Additionally, these assessments are typically related to predefined areas, such as ones postal address. Together, this means that the influences of outside environments such as individuals' schools, workplaces and shopping environments have been widely disregarded as potential environmental cues (Ball & Thornton, 2013). Individuals pass through many environments outside of their home address each day; therefore, when analysing the influence of environmental cues it is essential that the frequent movement of individuals be incorporated so that environmental cues can be accurately reviewed. The best way to achieve this is through record of moment-to-moment environmental exposures and real-time recording. Finally, both healthy and unhealthy options in individuals' environment need to be examined so the relative impact of each can be determined (Thornton and Kavanagh, 2012).

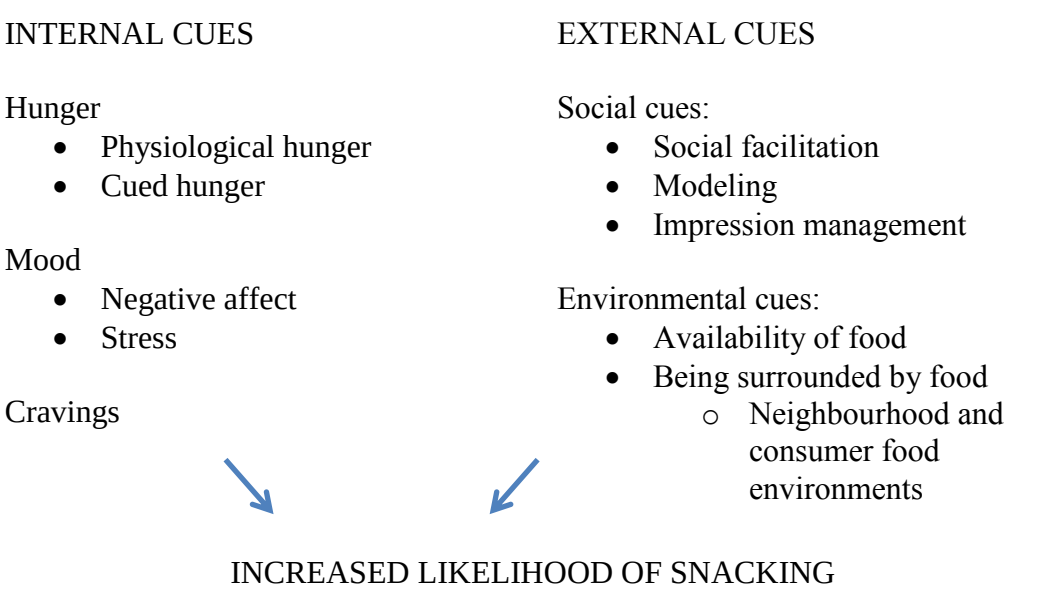

Fig. 1. Diagram of the stimulus-dependent model influencing snacking propensity

Since eating is largely context-dependent, it is essential to study people in their everyday environment. For that reason, this study employs Ecological

Momentary Assessment (EMA). In an EMA study, a participant typically carries a mobile device that serves as an electronic diary with them at all waking hours for a set period of days. Participants log their food and drink intake on their mobile device as well as report contextual information such as their mood, hunger level and report the environment they are in (Grenard *et al*., 2013). Additionally, the device requires participants to answer randomly issued surveys throughout the day. This serves to capture the flow of the participants' mood, behaviour, and the events in the minutes/ hours before the eating event occurred (Shiffman *et al.*, 2008). As participants complete multiple reports, a detailed picture of their experiences and behaviour is obtained. This allows for careful examination of how individuals eating patterns vary over time and across situations (Shiffman *et al.*, 2008). Ultimately, EMA studies allow for detailed insight into how an individual's behaviours changes over time, as well as and how they are shaped by various contexts (Shiffman *et al.*, 2008).

Unlike maintaining a pen and paper dairy, EMA studies enable participants to make reports in real time, which allows for a more accurate description of one's current state (Shiffman *et al.*, 2008), ultimately minimizing the risk of recall biases (Berkman, Giuliani & Pruitt, 2014). Additionally, EMA methods overcome the issues revolved around underreporting that are present in traditional methods of assessing nutritional intake. Snacking, in particular is often an underreported behaviour in overweight and obese populations (Barnes, French, Harnack, Mitchell & Wolfson, 2015). EMA methods are likely to overcome this bias, as the device enables individuals to report their food intake quickly and electronically, without having to recount every eating event or having a list of their food intake in front of them (which may also cause social desirability biases in the reports of food intake).

EMA is therefore a less threatening means of assessing ones food intake than traditional nutrition measures have so far achieved.

EMA reports are issued and completed in an ecologically valid manner (Grenard *et al.,* 2013; Shiffman *et al.,* 2008). They are completed on a daily basis within an everyday environmental context, which makes them an accurate reflection of reality. This additionally means that EMA reports are less likely to be prone to any behavioural biases that may be present when studying people in laboratory settings.

Lastly, EMA studies track the triggers driving certain behaviours, an essential component of this research. Often such triggers are not recognized by the affected individual, and can therefore not be captured by traditional measures that examine nutritional-intake such as pen-and-paper assessments and retrospective food diaries (Grenard *et al.,* 2013). The ability of EMA to measure food intake in conjunction with individual, social, and environmental factors enables a complex understanding surrounding the various cues that lead individuals towards snacking.

Rationale and hypotheses

Individuals with BMIs exceeding 25 are more susceptible to social and emotional factors that influence their health behaviours, than individuals with lower BMIs (Renner *et al.,* 2012; Thomas, Doshi, Crosby & Lowe, 2011). Therefore, this study will examine the relationship between individual, social, and environmental factors driving snacking in overweight and obese individuals. By combining individual and situational factors cueing snacking we are able to develop a more complex understanding of what predicts individuals snacking beyond what previous research has achieved.

The primary aim of this research is to understand what factors influence individuals' snacking choices. This will be achieved through examining two broad research questions:

Research question 1: To what extent is snacking influenced by negative affect in an overweight/ obese population? In accordance with the existing literature (e.g. Groesz *et al.,* 2012; Loxton *et al.,* 2011), it is hypothesised that negative affect will result in increased snacking intake.

Research question 2: To what extent is snacking influenced by social cues? Previous research suggests that individuals match their food intake to similar levels of people in their group (Vartanian *et al.,* 2013), whereby individuals are influenced to eat more or less depending on whom they are with and what they are doing. Accordingly, it is predicted that individuals will be more likely to snack if there are others eating in view.

Research question 3: To what extent is snacking influenced by environmental cues? Previous studies suggest that exposure to palatable foods brings individuals attention to such foods, making them hard to resist and likely to be eaten (Rogers & Hill, 1989; Li *et al.,* 2009). Exposure to food and food outlet availability will be the main determinants of environmental cues to snacking examined in this study. Therefore, it is hypothesized that when people are around food, which implies that food is available; or they are around numerous food outlets, they are more likely to eat a snack.

In addition, a secondary aim was established to examine the relationship between snacking and BMI. We hypothesised that BMI would moderate the relationship between internal (negative affect) and external cues (food availability, having others eating in view, and being in neighbourhoods with a high density of

food outlets) on snacking. Additionally, we expected that individuals with higher BMIs would have a higher frequency of snacking than those with lower BMIs.

Method

Overview

As part of this study, participants were asked to record their eating and drinking over 14 days using a customised hand-held device. Participants were also asked to respond to random assessments during the day. This allowed for the comparison of what cues were present during eating events versus cues present at random times. The focus of this study was to examine what factors cue snacking and whether BMI is a moderator for these effects.

Participants

Fifty-one adults (17 males and 34 females) were involved in this research. Participants were recruited via poster advertisements around the University of Tasmania (Sandy Bay campus), a University of Tasmania media release (April 8, 2015), a newspaper article in *The Mercury* (April 13, 2015), and through a student research participation database. To be eligible to participate, individuals were required to be over 18 with a BMI of at least 25, were not dieting, and were not previously diagnosed with an eating disorder of any variety.

Procedure

The Tasmanian Social Science Human Research Ethics Committee approved this study (ethics reference number H0014439). Written informed consent was obtained from all participants at the start of the study, before beginning any research procedures. Data was collected between April 2015 and July 2015 at the Sandy Bay campus of the University of Tasmania.

During the initial appointment (~45 minutes in duration), participants came into a university lab where their contact details were recorded and a baseline questionnaire was completed (see Appendix C). The baseline questionnaire assessed participants' everyday eating and drinking patterns, self-reported height and weight information, as well as recorded some personality traits through the use of the Behavioural Activation/ Inhibition Scale (Carver & White, 1994); Centre for Epidemiological Studies Depression Scale (Radloff, 1977); the Power of Food Scale (Lowe *et al.,* 2009); and the Yale Food Addictive Scale (Gearhardt, Corbin & Brownell, 2009); results from these scales were not analysed in the present study. During this visit, participants were issued a mobile telephone (EMA device) that had been stripped of its native functionality to run study-specific software. Participants received one-to-one training on the use of the device and the EMA protocol. They also practiced answering the assessment reports on the device prior to the commencement of their monitoring period.

Participants were instructed to use their device to record each time they consume a meal, snack or drink (excluding water) for the duration of their participation. After each report, the device created a time stamp specifying when the reported was completed. Assessment of eating reports occurred in two stages;

participants reported everything they ate (stage one), and stage two, where only a subset of the reports were selected for full assessment.

In stage one of the assessments, participants were asked to complete an assessment of their current mood state, as well as contextual and situational details specifying where they were and what they were doing. Similar to the stage one assessments, the stage two reports were recorded with a time stamp, but unlike the stage one reports no follow-up questions surrounding contextual and situational details were issued. Additionally, the device randomly prompted participants (~3 times per day) for "non-eating assessments". The non-eating assessments asked similar questions to the stage one eating assessments and were used as comparison events to assess stimulus-dependent eating and drinking patterns.

During the hours of 7pm and midnight, participants completed an "evening report", which gathered a global assessment of their mood, craving, and exercise over the day. Once participants completed the "evening report", the device was put to "bedtime mode", which suppressed random prompts over the night. Upon waking up, participants completed a "morning report", which assessed their mood, level of alertness, and craving prior to their first meal or drink of the day. The random prompts were re-initiated once the "morning report" had been completed.

A few (~2-4 days) days into the study participants came back into the lab for a brief visit (~10-15 minutes). Participants' EMA data was uploaded and reviewed to ensure they were adhering to study protocol. Participants had the opportunity to review their data and ask questions. Participants received EMA and device retraining where appropriate.

EMA monitoring concluded on or around day 14 of the study. Participants came into the lab (~15 minute visit) to receive debriefing, and return their device and

charger. During this final meeting, participants were issued with either 3 hours research participation (first year psychology students), or a $50 Coles/ Myer voucher as compensation for their time and contribution to the study.

Assessment

Assessment items were based on previous EMA research on stimulus-control dietary behaviours for specific food types and alcohol intake, in a non-clinical population (Schüz, Bower & Ferguson, 2015). All reports were administered and recorded on the EMA device's touch-screen. Responses consisted of one of several types: a) quantitative responses, b) qualitative responses that required selecting a single option, or c) qualitative responses that required selecting multiple responses. Each report covered multiple individual (affect) and situational and contextual domains (food availability, others eating, food outlets). In both eating and non-eating assessments (i.e. random prompts issued by the device), participants were asked questions about their surrounding location, the availability of food, the types of food outlets around, who they were with, were there others eating in view, the activity they were doing, and any food cravings they were experiencing.

For assessments of affect, participants were asked to indicate their mood by ratings across 10 affect descriptors: alert; angry; bored; calm; focus; happy; irritable; stressed; restless; sad; overall mood and energy level. Descriptors were assessed on a 0–100-point visual analogue scale, whereby participants moved a pointer to indicate their response. Following a maximum likelihood factor analysis that confirmed a two-factor structure, affect data were summarized into a score for either positive affect (using the mean scores for alert, calm, focus, happy, energy) or negative affect (using the mean scores for angry, bored, irritable, stressed, restless, sad). As outlined

in the research aims, subsequent analyses focused on negative affect, as it is demonstrated to have a greater effect on snacking intake than positive affect.

For assessment of others eating, participants were asked “when you decided to eat were there people eating?” Responses were qualitative and required selecting a single option: “yes” or “no”.

For assessment of food availability, participants were asked to indicate what food was available at that time. Responses were qualitative, which required checking boxes of available food types (Figure 2).

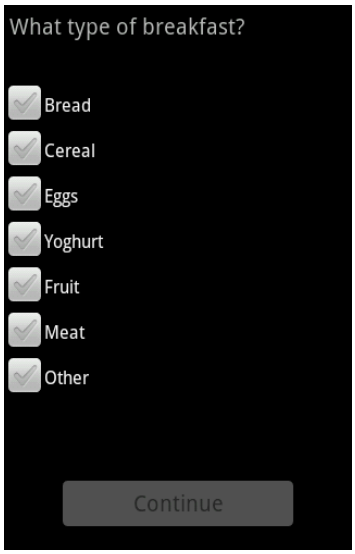

Fig. 2. Example of a qualitative EMA assessment question asking what type of breakfast a participant had.

Assessments of outlet density were assessed twofold: firstly, participants were asked what food outlets were around them (qualitative response with the option to select multiple responses); and secondly, outlet density was determined by adding the number of food outlets.

The device was programed to issue questions based on participants' responses; for example, participants who said they were working were clarified on the nature of the work (e.g. job, school, personal, other). Before submitting each report, participants could go back and edit previous responses. However, after submission, responses were stored and could not be altered or viewed on the device. Snack reports were gathered by food reports made in real-time and in an evening report, whereby participants could report any meals, snacks or drinks they missed during the day. On conclusion of the study and during each participant visit to the lab, data was uploaded to a secure server on a password-protected computer.

Analysis

Our primary objective was to examine the influence of internal and external cues on snacking. To examine this, we compared which internal and external covariates were present during snacking events with those present during the non-eating events (i.e. the random prompts) using multilevel logistic regression analysis.

For each assessment (including random prompts and food logs), the likelihood of this being reported as a main meal, snack, or random prompt was predicted from internal and external covariates (see explanation below for analysis of each covariate). As EMA data encapsulates reports made by the same individuals over many days, a multilevel logistic regression analysis with random intercepts and random slopes was used to account for the hierarchical structure of this data set. The Intraclass Correlation (ICC) for snack reports vs. random prompts was 0.06, which indicated a multilevel analysis was required as there was substantial difference between participants (Snijders & Bosker, 2012). Similarly, the total number of snacks per day was subject to substantial individual differences, with an ICC of 0.52,

indicating that 52% of the total variance in this variable was attributable to individual differences. MPlus was used for the analysis of results, using maximum likelihood estimation with robust standard errors (MLR).

We analysed the covariates of dietary behaviours in two separate parts. First, a random effects (random intercepts and random slopes) logistic regression model including the covariates (negative affect; others eating; food availability or outlet density) was fitted to the data. This was analysed to estimate the effects of internal and situational cues to snacking. Negative affect was coded as 1 (negative affect present) or 0 (negative affect not present); others eating (in group and in view) 1 (none) 0; availability of food items in the environment (confectionery, savoury, dairy products, biscuits, fast food, or others; all coded as 1), 1= present, 0= not present; and outlet density (franchised fast food, other fast food, sit down restaurant, supermarkets, smaller food shop, convenience store, specialty food shop, chemist or bargain shop; all coded as 1), 1= present, 0= not present.

In the second part of the analysis, all covariates from the first step of the analysis were examined for BMI effects. Firstly, the relationship between overall frequency of snacking and BMI was examined. In a second set of analyses, potential cross-level interaction effects of the covariates with individual BMI were examined in separate analyses.

Results

Overall, there were 745 days of monitoring available for analysis. Each participant completed an average of 14 days of monitoring (M= 14.61, SD= 1.46). Participants received an average of 2.62 random prompts per day. A total of 1953 random prompts were issued throughout the study period, with participants

completing 1861 of them, rendering an overall compliance rating of 95.29%. On average, 2.64 (*SD*= 0.68) meals were reported per participant per day. Average snack intake was examined twofold; firstly, using snack intake reported in real time; mean of 1.19 snacks per day (*SD*= 0.87); and secondly, using the number of snacks as reported in the evening report; providing a mean of 2.05 (*SD*= 1.31) snacks per day. To reduce the chance of missing snack reports, subsequent analysis based snacking frequency on the evening reports. Over the course of the study, a total of 1861 random prompts were completed, 680 main meals and 678 snacks were reported.

Sample Characteristics

Participants' ages ranged from 19 to 73 (*M*= 38.31 years, *SD*= 14.87 years). Participants BMIs ranged from 23.83 to 45.7 (*M*= 30.77, *SD*= 4.85). 25 participants were classified as overweight and 24 as obese. Two participants had BMIs under 25 (one had a BMI of 23.83, the other a BMI of 24.97); however, BMI is not a physiologically relevant cut-point and they self-reported as being overweight, both participants were retained in the analysis of this research.

Covariates of snacking

In the first part of the random effects multinomial logistic regression analysis, snacking was regressed on negative affect, presence of other people eating, food availability, and outlet density (Table 1) with random prompts as the reference category. This means that each Odds Ratio indicates how much more or less likely it is that the report is a snack report compared to being a random prompt if the specific covariate increases by one unit. For the categorical covariates (others eating, food availability, outlet density) the Odds Ratio indicates the likelihood of snacking if the

covariates are present vs. absent. In the case of negative affect, the Odds Ratio indicates the likelihood of snacking when a one unit increase in negative affect. Including random intercepts accounts for participants differing in their base likelihood of snacking, while including random slopes allows the effects of the covariates to differ between participants. The intercepts and coefficients reporting in are pooled estimates of these effects. Table 1 shows that the likelihood of snacking increased if individuals were experiencing negative affect, or were around others who were eating, or had food available.

Table 1

Summary of random effects multinomial logistic regression analysis: parameter estimates, standard errors and odds ratios of each covariate cueing snacking intake.

	Parameter estimate (*SE*)	Odds ratio (95% CI)
Negative Affect	0.02 (0.01)**	1.02 (1.01,1.03)
Others Eating	1.23(0.27)***	3.42 (1.99,5.88)
Food Availability	1.50 (0.20)***	4.48 (3.06,6.23)
Outlet Density	0.02 (0.04)	1.02 (0.94,1.10)

Note. *$p < .05$, **$p < .01$, ***$p < .001$

Food availability was the strongest predictor of snacking (see Figure 3). A report was 4.48 times more likely to be a snack report than a random prompt if food was available (Table 1). When others are eating, a report was 3.42 times more likely to be a snack report than a random prompt. Thus, seeing others eat cues eating. Additionally, a report was 1.02 times more likely to be a snack report than a random prompt if negative affect ratings increased by one unit, demonstrating that internal cues are a significant predictor of snacking. The effect of outlet density was non-significant; being surrounded by food outlets did not cue snacking intake.

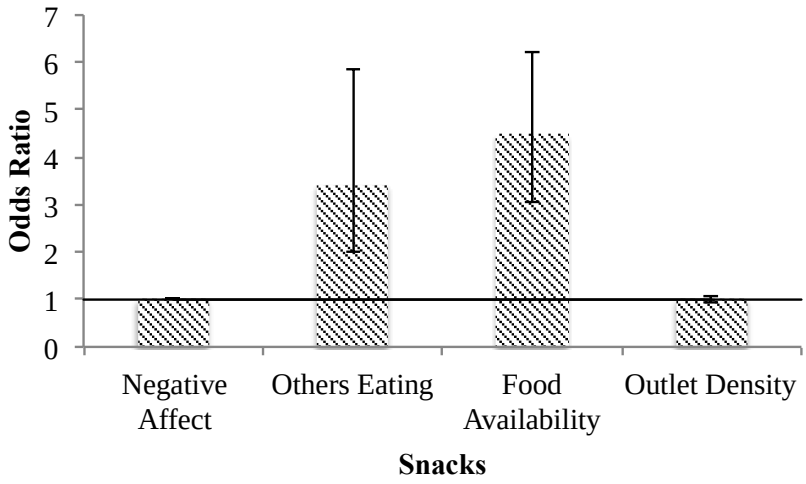

Fig. 3. Odds ratios of each cue increasing the likelihood of snacking

The second set of analyses examined BMI as a moderator of the cue effects. The first part of this analysis involved a multilevel regression analysis examining whether an individual's average frequency of snacking could be predicted by their BMI. Average daily snacking frequency (M= 2.05, SD= 1.31) was not significantly correlated with BMI (r= 0.02, p= .32) (refer to Figure 4). Multilevel logistic regressions for all covariates separately including cross-level interactions between person-level (BMI) and occasion-level (cues) covariates of snacking (BMI*Intercept) in all analyses, and BMI did not interact significantly with any of the cues (Table 3).

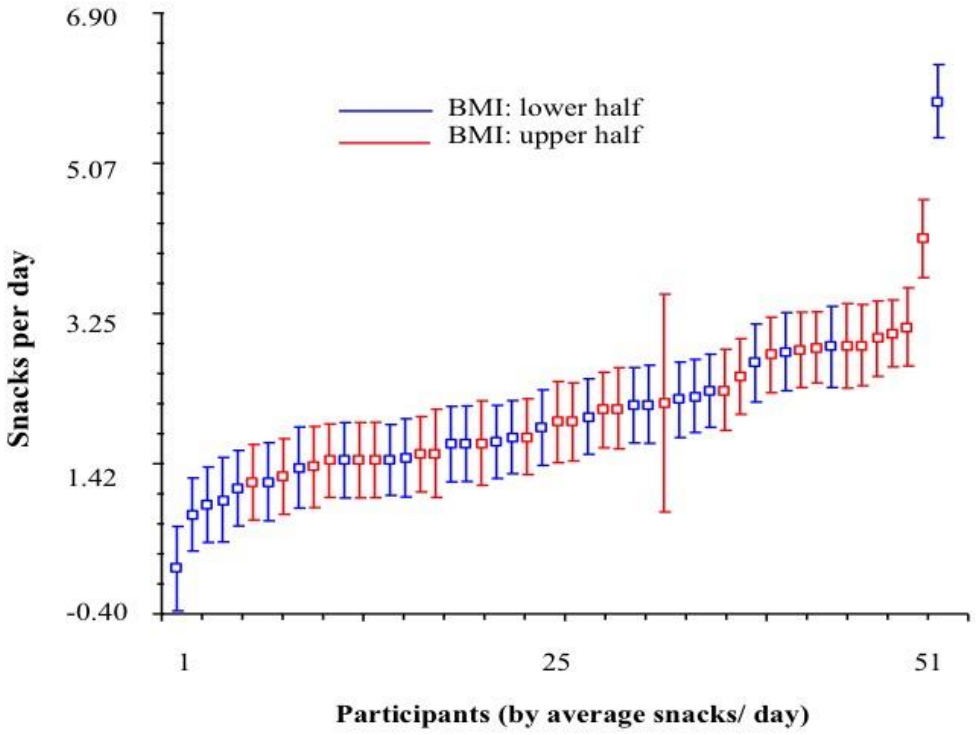

Fig. 4. Participants ordered by intercepts of snacks per day and BMI

Note. 95% Confidence Intervals around the average number of snacks per day

Table 3

Summary of random effects multinomial logistic regression analysis: dietary behaviours regressed on internal and external stimuli using random prompts as reference category on the within-participants level and BMI as a moderator.

		Odds Ratios (95% CI) of Internal and External Cues (Covariates)			
		Negative Affect	Others Eating	Food Available	Outlet Density
Fixed Effects	Intercept	1.52 (1.18,1.87)***	1.57 (1.28,1.87)***	1.60 (1.30,1.89)***	1.45 (1.24,1.76)***
	BMI*Intercept	1.01 (0.96,1.06)	1.01 (0.96,1.06)	1.01 (0.95,1.07)	1.01 (0.95,1.06)
	Slope Cue	1.01 (1.00,1.02)**	3.67 (2.34,5.81)***	4.48 (3.71,5.42)***	1.03 (0.99,1.06)
	BMI*Slope Cue	0.10 (0.10,1)	1.00 (0.89,1.13)	1.02 (0.98,1.06)	0.99 (0.99,1)
Random Effects (Residual Variances)	Intercept	0.49*	0.57***	0.56**	0.46**
	Slope Cue	0.00	1.31*	0.003	0.00

Note. *$p < .05$, **$p < .01$, ***$p < .001$

Discussion

This study examined the influence of internal and external cues on snack intake over an approximate 14-day monitoring period in an overweight and obese convenience sample. EMA methods were used to gather food reports and assessments of individual and situational cues to snacking. This study supports a significant role of internal cues guiding snacking; negative affect increased the likelihood of snacking. It also supports the role of external cues in shaping individuals snacking. In accordance with our hypothesis, social cues influenced the likelihood of snacking; snacking was more likely if there were others eating in view. Furthermore, this study also supports the influence of environmental cues guiding food intake, whereby individuals were much more likely to consume snacks if there was food available. However, contrary to our hypothesis, being in areas of high food outlet density did not significantly cue snacking intake. Findings from this study did not support the hypotheses relating to BMI either; BMI did not moderate the relationship between internal and external cues on snacking, nor was there a significant relationship between BMI and snacking frequency.

Stimulus control and snacking

Overall, the findings from this research are in line with previous research suggesting that snacking is highly influenced by an individual's situation and context (Lowe & Butryn, 2007). It also provides further support for the influence of negative affect, seeing others eating, and having food available in cueing snacking intake. Consistent with previous studies (e.g. Schüz, Bower & Ferguson, 2015), having food available and observing others provide the strongest cues to eat. The experience of

negative affect was also a significant predictor of snacking intake. This contributes support to the debate surrounding the influence of mood on dietary behaviours, whereby some theorists argue that food intake increases when individuals are experiencing negative affect (Dressler & Smith, 2013; Groesz *et al.,* 2012), whereas others suggest food intake can decrease during such situations (Sproesser *et al.,* 2014).

Findings from this research suggest that individuals snacking behaviours are largely guided by cues. As anticipated, snacking was guided by stimulus-control whereby cued hunger influences snacking rather than physiological hunger requirements (Lowe & Butryn, 2007). Both internal and external cues were found to influence the likelihood of snacking. Internal cues (such as the experience of negative affect), and external cues (such as seeing others eat and having food available) direct an individual's attention towards food sources, thus increases their motivation, and subsequently, their decision to eat (Hofman *et al.,* 2010). Consequently, this research provides further evidence in support of context-dependent snacking under a stimulus-control model.

Individual cues guiding snacking

When discussing the influence of negative affect in cueing snacking, it is important to take into account the measurement and scale of negative affect. In this study, negative affect was measured on a 0-100 point scale, and included mean scores of subjective ratings for being angry, bored, irritable, stressed, restless and sad. An increase of being 1.02 times more likely to snack with a one point increase in negative affect is unlikely to be meaningful on such a small scale. . However, in reality, if an individual is experiencing negative affect they are unlikely to increase

their subjective rating of negative affect by one point; they are more likely to increase their negative affect rating by, for example, 20 points, which would mean that the likelihood of snacking would increase 1.5 fold, or by 50%, a large effect if considered on a more practical and realistic level.

Findings from this study contribute to the debate surrounding the effect of negative affect on eating. In this study, negative affect significantly predicted snacking. This finding is inline with research that suggests negative affect (namely, stress), leads to increased consumption of palatable, non-nutritious foods (Dressler & Smith, 2013; Groesz *et al.,* 2012; Ozier *et al.,* 2008). Typically this involves an individual replacing their meals with eating energy-rich snacks (O'Connor *et al.,* 2008). Other studies have noted this effect is subject to great individual difference, whereby some people follow this overeating pattern, and others reduce food intake in times of stress (Sproesser *et al.,* 2014). The current study suggests that individuals in an overweight and obese population are more likely to eat in response to negative affect than they are to under eat or skip meals. Thereby supporting the notion of food being used as a mechanism for dealing with negative emotions (Groesz *et al.,* 2012; Torres & Nowson, 2007). It is possible that this disproportionally affects individuals with overweight and obesity, however more evidence would need to be gathered to support this hypothesis.

A concern of this pattern may be that individuals with overweight and obesity lack the appropriate resources to cope with their emotions, so instead they turn to food for emotional control (Ozier *et al.,* 2008). This raises significant implications in terms of how to effectively manage eating behaviour. Perhaps increased promotion of ways to effectively regulate emotions is necessary so that individuals have an alternative to food as a means of emotional regulation. Daubenmier *et al.* (2011)

conducted a mindfulness intervention program with overweight/ obese women and found participants in the program improved in mindfulness, anxiety, and most importantly, in external-based eating. This suggests that including stress prevention in eating interventions has the potential to reduce the effect of negative affect and eating, a finding worth investigating considering the increased likelihood of snacking when experiencing negative affect.

Social cues guiding snacking

Social cues were assessed as a part of the influence of external factors guiding dietary intake under a stimulus control model. It was found that seeing others eat significantly increases the likelihood of snacking almost fourfold. This finding supports the notion of social cues guiding snacking. In particular, this research supports a social facilitation effect guiding snacking (Herman *et al.,* 2003). Participants were more likely to snack with these social cues present compared to when the social cues were not present. It is likely that some of this effect was due to modelling, whereby seeing others eat served as a cue to eat too. Having others eat nearby indicates that it is an appropriate time and place to eat, which effectively functions as granting an individual permission to eat as well (Herman *et al.,* 2003). Social facilitation and modelling are therefore considered to be strong cues guiding snacking.

The research found snacking increased when there were others eating in view, which does not support the notion of impression management. Impression management means that individuals eat less when they perceive others are evaluating them (Herman *et al.,* 2003). The finding that snacking increases in the presence of others suggests the effects of social cues are unidirectional, facilitating food intake

rather than restricting it. Perhaps an impression management effect would have been present if we had of measured the quantity of food intake rather than just assess the likelihood of snacking. It is possible that if impression management influences eating practices, that it only serves to control the portion size that individuals eat, rather than obstruct food intake altogether. Nevertheless, in general, social cues are a significant influence in shaping individuals dietary behaviours.

Environmental cues guiding snacking

The finding that food availability significantly predicts snacking is in line with previous literature examining the influence of environmental cues on dietary intake. Previous research has examined food availability in terms of having exposure to foods. Ferriday and Brunstrom (2011), for example, examined how exposure to foods is linked to 'cued hunger', whereby being exposed to food increases an individual's physiological response and therefore motivation to eat. Having food readily available can trigger physiological reactions such as the release of insulin; increasing salivation, heart rate, gastric activity and blood pressure. These physiological mechanisms serve as cues to increase an individual's preparedness and motivation to eat (i.e. it cues hunger). Additionally, this effect has been shown to be stronger among those classed as overweight or obese (Ferriday & Brunstrom, 2011). It is therefore extremely likely that individuals respond to food cues in their environment, rendering food availability a significant predictor of snacking.

However, the presence and density of food outlets did not significantly predict snacking. It is possible that outlet density was not a significant cue to snack because participants lived and worked in urban areas where they were constantly surrounded by food outlets. Population trends have shown that there has been an

increasing trend to live in an urban city environment compared to more remote areas (ABS, 2008). A consequence of this trend has meant that individual's are constantly saturated by advertisements for food stores, and are constantly around food outlets. A result of this may be that individuals are no longer cued to eat by simply being around food outlets (as they have grown accustomed to them always being around). This may have been of particular concern to this study as approximately 44% of participants lived and worked in suburbs closely surrounding Hobart (including Hobart, South Hobart, Sandy Bay and Battery Point), with an additional 42% living slightly further out of Hobart (including suburbs such as Kingston, Blackmans Bay, Glenorchy, Berriedale and Montrose). The remainder of the participants (approximately only 14%) lived outside of these urbanized areas (in suburbs such as Huonville and Cygnet). The narrow spread of participants' home addresses means that very little environmental diversity was examined, rendering the effect of environmental cues on dietary behaviour difficult to ascertain.

Up to 45% of eating tends to occur in the same physical location almost everyday (van't Riet, Sijtsema, Dagevos & De Bruijn, 2011). This could mean that eating is largely due to habit (as reported by van't Riet *et al.*), or that the environment has consistent influences on eating, which may imply that our study was unable to adequately assess the influence of the environment on snacking intake. If the environment provides a stable cue for eating, then a wide range of environmental experiences and contexts would need to be examined in order to appreciate the full extent of how the environment cues snacking.

BMI and snacking

Contrary to hypotheses that BMI would moderate the relationship between internal and external cues on snacking, it did not. Furthermore, BMI did not predict snacking frequency; individuals with higher BMIs did not snack more than those with lower BMIs. Previous research has reported inconsistencies between the relationship of BMI and snacking (e.g. Johnson & Anderson, 2010), whereby it has been unclear whether it is the frequency, the size, or the quality of snacks that drive overweight and obesity (Kant, 2000; Zizza *et al.*, 2001). The non-significant relationship between snacking frequency and BMI in this research may suggest that in the weight range examined, there are no marked differences in snacking frequency according to weight.

The current study did not find a significant relationship between BMI moderating the effects of internal and external cues on snacking. Perhaps this was because the BMI range examined was limited to those classed as either overweight or obese. Although this study was designed to focus on this population, it may have restricted investigating the true influence of BMI on dietary behaviours. The incorporation of individuals from across the BMI spectrum (underweight, normal weight, overweight and obese) rather than restricting the sample to the upper BMI range may have demonstrated a greater relationship between BMI and stimulus-control eating. Alternatively, and perhaps more likely, BMI in itself is not directly related to stimulus-control eating, rather it is an outcome of, rather than a predictor for, the influence of cues on dietary intake. It is likely that psychological variables (such as food addiction or impulsivity; Davis *et al.*, 2011, or the Power of Food, Cappelleri *et al.*, 2009) cue snacking and this differs between individuals on a level

perhaps unrelated to their BMI. This hypothesis warrants further investigation in future research examining the effect of cues on food intake.

Strengths and limitations

A key strength of this study was that it was the first to use EMA technology to examine stimulus control of individual and situational variables on food intake in a sample of individuals with overweight and/ or obesity. EMA technology holds many advantages over traditional pen-and-paper measures of dietary intake; the main advantage being it permits the study of individuals in their everyday environment capturing the flow of individuals' mood, behaviour and the events they experience prior to eating (Shiffman *et al.,* 2008). It achieves this through recording dietary intake in real time as well as repeated assessments of real-world contextual information such as the fluctuation in one's mood, location, and the activities they are engaged in. Additionally, EMA measures overcome issues with memory recall and the underreporting of snacks, which is a common problem in nutritional research (Heitmann & Lissner, 1995). In sum, EMA technology allows for a more ecologically valid study of dietary behaviours and their influences (Grenard *et al.,* 2013).

Despite these strengths, there are some limitations of this study that effect the interpretation of results. Firstly, the sample size in this study was relatively small (*N*= 51). However, EMA research is intensive and longitudinal in design, which means that smaller sample sizes are often adequate to gather sufficiently reliable estimates of the effects under study. The intensive nature of the design, that is, a combination of event-based monitoring (record of food intake) and time-based monitoring (random prompt assessments), allowed for a large number of

observations on the situational context of eating events to be collected (Shiffman *et al.,* 2008). Additionally, using random effects to model data patterns rather than using fixed effects further assisted with applying the results to a wider population (Schwartz & Stone, 1998). Nevertheless, replication of this study with a larger and more representative sample, ideally with the inclusion of participants form a wider BMI range would enable greater generalization of results to the community.

In this study, there was a discrepancy between the numbers of snacks reported in real-time compared to the number of snacks reported in the evening report. The evening report included a higher average number of snacks per day (*M*= 2.05 compared to *M*= 1.19 reported in real-time), which indicates that some snacks were unreported during the day. Although previous research (such as Barnes *et al.*, 2015) has suggested that there is a trend of overweight and obese individuals to underreport their snack intake, this is a significant limitation of this study as it may hinder examination of the cues underlying snaking. The inconsistency of reported snacks (although small) may suggest that participants were not engaging with the EMA monitoring as rigorously as we had anticipated. As the evening report served as a means to for participants to report snacks missed throughout the day, it is recommended that future research include an evening report whereby participants can reflect upon their dietary intake throughout the day and report any missed items. Reliance on the evening report alone would be subject to biased in memory recall (Berkman *et al.*, 2014) and should therefore only be used to compliment food reports made in real-time.

The dietary behaviour measured in this study is most likely to be incomplete. The type of food participants could report only included options for confectionary, savoury, dairy, biscuits, cakes, pastries, fast food or other. Although this study aimed

to focus specifically on snacking behaviours, in particular energy-dense foods, alternative food options were not assessed, as we did not include a qualitative option when the food type 'other' was reported. This is likely to have undermined the relationship between various contextual and individual cues on various types of dietary choices. Further investigation into the effect of cues on all food types is warranted.

In addition, this study did not account for habitual eating practices. A result of this may be that our distinction between internal and external cues on eating is irrelevant, or at the very least, makes distinguishing between food intake driven by contextual cues to that driven by habit. Although some have suggested that almost half of all food intakes are habitual (e.g. Gardner, de Bruijn & Lally, 2011), these studies typically consider habitual eating to reflect time-based cues (such as eating because it is 'lunch time', or eating cereal for breakfast everyday), rather than event-based cues as was the focus of the present study. Additionally, the baseline questionnaire in this research assessed participants everyday eating and drinking patterns so it is anticipated this flaw is overcome in the present study. Nevertheless future research should aim to separate the cause of eating with its consequence across various contextual and situational domains.

Lastly, the assessment of internal and external factors cueing food intake is likely to be incomplete. Our internal cues guiding eating may not have been extensive enough to encapsulate all the reasons why people eat and what they eat. As an example, we did not assess participants' experience of daily hassles. A daily hassle is a frequently encountered micro-stressor, which upsets the individual and has been found to predict stress eating, namely that of unhealthy snack items (O'Connor, Armitage & Ferguson, 2015). However, as we measured participants

mood over each day in their participation period, it is hoped that measurements of negative affect would fluctuate parallel to the number daily hassles experienced. This could be further examined in future research in this area.

Implications and conclusions

This research has shown that it is not just hunger in a physiological sense that drives individuals to eat. Instead, individuals are cued to eat, from internal cues (such as the experience of negative affect), and/ or external cues (such as social factors like seeing others eat, or environmental factors, such as having food available). Internal and external factors guiding food intake demonstrates snacking to be a behaviour determined by stimulus-control. Ultimately, this indicates that there are a multitude of reasons as to why individuals engage in snacking behaviour. Each cue needs to be addressed in order to adequately adopt measures to control the number of individuals affected by overweight and obesity.

The present study has important implications for the understanding of overweight and obesity, and could inform how to best support those affected by excess weight. This study shows that when an individual is experiencing negative affect, they are more likely to eat, similarly, seeing others eat also cues eating behaviours. The results suggest that individuals are more likely to eat when there is food available compared to when there is no food available to them. Together, this information indicates that behavioural interventions targeted at preventing obesity should focus on a) providing education surrounding alternative ways to control negative affect that do not involve turning to food to regulate mood, b) designing measures so that individuals do not feel compelled to eat when they are in the

company of others eating, and c) implementing strategies to ensure individuals pack healthier foods so the food that is readily available to them is a healthier option.

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Table of Appendices

Appendix A

Flyer advertisement


Do you have or know someone with
a BMI over 25?
The University of Tasmania is looking for participants with a BMI > 25 for a study into everyday eating and drinking.
All participants will receive a $50 Coles/Myer gift card on completion of the study
Visit our website for information and contact details:
www.tiny.cc/nutritionstudy
Or call us on (03) 6226 1093
School of Medicine
UNIVERSITY of TASMANIA
Ethics Approval No. H0014439

Appendix B

Ethics Approval Letter

Social Science Ethics Officer
Private Bag 01 Hobart
Tasmania 7001 Australia
Tel: (03) 6226 2763
Fax: (03) 6226 7148
Human.ethics@utas.edu.au

HUMAN RESEARCH ETHICS COMMITTEE (TASMANIA) NETWORK

20 March 2015
Dr Benjamin Schuez
Psychology
Private Bag 30

Sent via email

Dear Dr Schuez

Re: APPROVAL FOR AMENDMENT TO CURRENT PROJECT Ethics Ref: **H0014439 - Individual and situational predictors of food choices in overweight and obesity**

- Change of title to 'Individual and situational predictors of food choices in overweight and obesity'.
- Addition of student investigator Katherine Elliston.
- Participants will also be asked to photograph their food and drink consumption using the camera built in the EMA smartphones.
- Revised Information Sheet and Consent Form.
- Advertisement through Facebook and through the SONA system.

We are pleased to advise that the Chair of the Tasmania Social Sciences Human Research Ethics Committee approved the Amendment to the above project on 20/3/2015.

Yours sincerely

Katherine Shaw

Executive Officer

Tasmania Social Sciences HREC

Appendix C

Baseline Survey

1. **What is your current age?** (type number of years)
2. **What is your gender?** (female, male)
3. **What is your ethnicity?**
    - Caucasian/ European
    - Aboriginal
    - Torres Strait Islander
    - Asian
    - Other
4. **What is the highest level of education that you have completed?**
    - Year 10 or less
    - Year 12
    - Some University
    - Graduated University
    - Graduated at TAFE
    - No answer
5. **Please estimate your current weight in kilograms** (type number in box below)
6. **Please estimate your current height in centimeters** (type number in box below)
7. **Do you do your own cooking/ meal preparation at home? Choose one of the following answers**
    - Rarely of none of the time
    - Some of the time (1-2 days per week)
    - Much of the time (3-4 days per week)
    - Most of the time (5-7 days per week)
8. **How often do you 'eat out' (e.g. at a restaurant/ café etc.)? Choose one of the following answers**
    - Rarely of none of the time
    - Some of the time (1-2 days per week)
    - Much of the time (3-4 days per week)
    - Most of the time (5-7 days per week)
9. **How often do you eat 'take away' or 'fast food' (e.g. McDonalds, Hungry Jacks, Subway)?**
    - Rarely of none of the time
    - Some of the time (1-2 days per week)
    - Much of the time (3-4 days per week)
    - Most of the time (5-7 days per week)
10. **How many times per day, week, or month did you usually eat or drink…**

	never	1-3 times last month	1-2 times per week	3-4 times per week	5-6 times per week	1 time per day	2 times per day	3 times per day	4 or more times per day
Cold Cereal?	○	○	○	○	○	○	○	○	○
Milk, either to drink or on cereal?	○	○	○	○	○	○	○	○	○
Bacon or sausage, not including low-fat, light, or turkey varieties?	○	○	○	○	○	○	○	○	○

Hot dogs made of beef or pork?	○	○	○	○	○	○	○	○	○
Whole-grain bread including toast, rolls, and sandwiches? Whole-grain bread includes whole wheat, rye, ioatmeal, and pumpernickel.	○	○	○	○	○	○	○	○	○
100% fruit juice such as orange, grapefruit, apple and grape juices? Do not count fruit drinks such as Kool-Aid, lemonade, cranberry juice cocktail, Hi-C and Tang.	○	○	○	○	○	○	○	○	○
Fruit? Count fresh, frozen or canned fruit. Do not count juices.	○	○	○	○	○	○	○	○	○
Regular-fat salad dressing or mayonnaise, including on salad and sandwiches? Do not include low-fat, light or diet dressings.	○	○	○	○	○	○	○	○	○
Lettuce or green leafy salad, with or without other vegetables?	○	○	○	○	○	○	○	○	○
French fries, home fries or hash browns?	○	○	○	○	○	○	○	○	○
Other white potatoes? Count baked potatoes, boiled potatoes, mashed potatoes and potato salad. Do not include yams or sweet potatoes.	○	○	○	○	○	○	○	○	○
Cooked dried beans, such as refried beans, baked beans, bean soup and pork and beans?	○	○	○	○	○	○	○	○	○
Other vegetables? Count any form of vegetable: raw, cooked, canned or frozen. Do not count: lettuce salads, white potatoes, cooked dried beans, rice.	○	○	○	○	○	○	○	○	○
Any kind of pasta? Count spaghetti, noodles, macaroni and cheese, pasta salad, rice noodles, soba and any other kind of pasta.	○	○	○	○	○	○	○	○	○
Peanuts, walnuts, seeds or other nuts? Do not include peanut butter.	○	○	○	○	○	○	○	○	○
Regular-fat potato chips, tortilla chips or corn chips? Do not include low-fat chips.	○	○	○	○	○	○	○	○	○

11. BIS/BAS

	Very true for me	Somewhat true for me	Somewhat false for me	Very false for me
A person's family is the most important thing in life.	○	○	○	○
Even if something bad is about to happen to me, I rarely experience fear or nervousness.	○	○	○	○

I go out of my way to get things I want.				
When I'm doing well at something I love to keep at it.				
I'm always willing to try something new if I think it will be fun.				
How I dress is important to me.				
When I get something I want, I feel excited and energized.				
Criticism or scolding hurts me quite a bit.				
When I want something I usually go all-out to get it.				
I will often do things for no other reason than that they might be fun.				
It's hard for me to find the time to do things such as get a haircut.				
If I see a chance to get something I want I move on it right away.				
I feel pretty worried or upset when I think or know somebody is angry at me.				
When I see an opportunity for something I like I get excited right away.				
I often act on the spur of the moment.				
If I think something unpleasant is going to happen I usually get pretty "worked up."				
I often wonder why people act the way they do.				
When good things happen to me, it affects me strongly.				
I feel worried when I think I have done poorly at something important.				
I crave excitement and				

new sensations.

When I go after something I use a "no holds barred" approach.				
I have very few fears compared to my friends.				
It would excite me to win a contest.				
I worry about making mistakes.				

12. CES-D

For each of the following statements, please indicate if you felt this way during the past week.

	Rarely of none of the time (less than 1 day)	Some of the time (1-2 days)	Much of the time (3-4 days)	Most of the time (5-7 days)
I was bothered by things that usually don't bother me				
I did not feel like eating; my appetite was poor				
I felt that I could not shake off the blues even with help from my family and friends				
I felt that I was just as good as other people				
I had trouble keeping my mind on what I was doing				
I felt depressed				
I felt that everything I did was an effort				
I felt hopeful about the future				
I thought my life had been a failure				
I felt fearful				

My sleep was restless	◯	◯	◯	◯		
I was happy	◯	◯	◯	◯		
It seemed that I talked less than usual	◯	◯	◯	◯		
I felt lonely	◯	◯	◯	◯		
People were unfriendly	◯	◯	◯	◯		
I enjoyed life	◯	◯	◯	◯		
I had crying spells	◯	◯	◯	◯		
I felt sad	◯	◯	◯	◯		
I felt that people disliked me	◯	◯	◯	◯		
I could not get going	◯	◯	◯	◯	◯	◯

13. PFS

Please indicate the extent to which you agree that the following items describe you.

	I don't agree	I agree a little	I agree somewhat	I agree quite a bit	I strongly agree
I find myself thinking about food even when I am not physically hungry	◯	◯	◯	◯	◯
I get more pleasure from eating than I do from almost anything else	◯	◯	◯	◯	◯
If I see or smell a food I like, I get a powerful urge to have some	◯	◯	◯	◯	◯
When I'm around a fattening food I love, its hard to stop myself from at least tasting it	◯	◯	◯	◯	◯
Its scary to think of the power that food has over me	◯	◯	◯	◯	◯
When I know a delicious food is available, its hard to stop myself from thinking about having some	◯	◯	◯	◯	◯
I love the taste of certain foods so much that I cant avoid eating them, even if they're bad for me	◯	◯	◯	◯	◯
Just before I taste a favourite food, I feel intense anticipation	◯	◯	◯	◯	◯
When I eat delicious food, I focus a lot on how good it tastes	◯	◯	◯	◯	◯
Sometimes, when I'm doing everyday activities, I get an urge to eat 'out of	◯	◯	◯	◯	◯

	I don't agree	I agree a little	I agree somewhat	I agree quite a bit	I strongly agree
the blue' (for no apparent reason)					
I think I enjoy eating a lot more than most other people	○	○	○	○	○
Hearing someone describe a great meal makes me really want to have something to eat	○	○	○	○	○
It seems like I have food on my mind a lot	○	○	○	○	○
It is very important to me that the foods I eat are as delicious as possible	○	○	○	○	○
Before I eat a favourite food, my mouth tends to fill with saliva	○	○	○	○	○

14. YFA-Scale

This survey asks about your eating habits in the past year. People sometimes have difficultly controlling their intake of certain foods such as:

Sweets like ice cream, chocolate, donuts, cookies, cake, candy, ice cream
Starches like white bread, rolls, pasta and rice
Salty snacks like chips, pretzels and crackers
Fatty foods like steak, bacon, hamburgers, cheeseburgers, pizza and french fries
Sugary drinks like soft drinks, red bull

When the following questions ask about 'certain foods', please think of ANY foods similar to those listed above, or any other foods you have had a problem with in the past year.

	Never	Once a month	2-4 times a month	2-3 times a week	4 or more times a week, or daily
I find that when I start eating certain foods, I end up eating much more than planned	○	○	○	○	○
I find myself continuing to consume certain foods, even when I am no longer hungry	○	○	○	○	○
I eat to the point where I feel physically ill	○	○	○	○	○
Not eating certain types of food, or cutting down on certain types of food, is something that I worry about	○	○	○	○	○
I spend a lot of time feeling sluggish or fatigued from overeating	○	○	○	○	○
I find myself constantly eating certain foods throughout the day	○	○	○	○	○
I find that when certain foods are not available, I will go out of my way to obtain them. For example, I will drive to the store to purchase	○	○	○	○	○

certain foods, even though I have other options available to me at home					
There have been times when I've consumed certain foods so often or in large quantities, that I started to eat food instead of working, spending time with my family or friends, or engaging in other important activities or activities that I enjoy	○	○	○	○	○
There have been times when I've avoided professional or social situations where certain foods are available, because I was afraid I would overeat	○	○	○	○	○
There have been times when I've avoided professional or social situations because I was not able to consume certain foods there	○	○	○	○	○
I have had withdrawal symptoms such as agitation, anxiety, or other physical symptoms when I cut down or stopped eating certain foods (please do NOT include withdrawal symptoms caused by cutting down caffeinated beverages such as soft drink, coffee, tea, energy drinks etc.)	○	○	○	○	○
I have found that I have elevated desire for or urges to consume certain foods when I cut down or stop eating them	○	○	○	○	○
My behaviour with respect to food and eating causes significant distress	○	○	○	○	○
I experience significant problems in my ability to function effectively (daily routine, job, school, social activities, family activities, health difficulties) because of food and eating	○	○	○	○	○

15. Please select the option from the following scale that best describes how often you have felt/ behaved this way in the last 12 months:

*

	No	Yes
My food consumption has caused significant psychological problems such as depression, self loathing, anxiety, or guilt	○	○
My food consumption has caused significant physical problems or made a physical problem worse	○	○
I kept consuming the same types of food or same amount of food even though I was having emotional and/or physical problems	○	○
Over time, I have found that I need to eat more and more to get the feeling I want, such as reduced negative emotions, or increased pleasure	○	○
I have found that eating the same amount of food does not reduce my negative emotions or increase pleasurable feelings the way it used to	○	○
I want to cut down or stop eating certain kinds of food	○	○

16. Please select the option from the following scale that best describes how often you have felt/behaved this way in the last 12 months:

	None	One time	Two times	Three times	Four times	Five or more times
How many times in the past year did you try to cut down or stop eating certain foods altogether?	○	○	○	○	○	○

Appendix D

Information Sheet

Private Bag 30 Hobart
Tasmania 7001 Australia
Phone (03) 6226 7471 Fax (03) 6226 7471
Email Benjamin.schuez@utas.edu.au

SCHOOL OF MEDICINE, PSYCHOLOGY

PARTICIPANT INFORMATION SHEET

Individual and situational predictors of food choices in people with a BMI over 25

1. Invitation

You are invited to participate in a research study investigating the drivers (''predictors'') and consequences of eating. The study is conducted by Dr Benjamin Schüz, Dr Stuart Ferguson, Dr Natalie Schüz and Katherine Elliston from the School of Medicine of the University of Tasmania.

2. 'What is the purpose of this study?'

The purpose of the study is to examine eating behaviour in people with a BMI of 25 and over from the ''input'' perspective. This means that we want to examine the drivers and consequences of eating, in particular the consumption of energy-dense food. Data will be gathered on the individual (e.g., craving, hunger, mood), as well as social and situational (e.g., location, company) antecedents of eating, as well as how people feel after eating. Results from this research have the potential to influence the development of more efficacious interventions to support a healthy diet.

3. 'Why have I been invited to participate in this study?'

You are eligible to participate in this study because you have a BMI of at least 25, are over 18, and interested in contributing to research about eating patterns.

4. What will I be asked to do?

If you choose to participate in this study, you will be required to take part in 14 days of monitoring (explained below).

While in the study, you will be monitoring your eating / drinking patterns and your feelings as well as experiences as you go about your daily life. To do this, we will supply you with a simple to use hand-held computer – which looks very much like a smartphone. You will need to return this computer at the end of the study. You will be asked to carry this computer with you at all times for the duration of the 14 day study.

You will need to carry the device with you wherever you go at all days of the study and record and photograph each time you consume any food or drink. Some of these recordings will be randomly followed up by a brief assessment consisting of questions asking about the social, emotional, and situational environment of where you had food or a drink. You will also be asked to complete 4-5 assessments at random time points during the day. Each assessment will only take about 1-2 minutes to complete. During these assessments, the device will also automatically record the location you are at. We will provide you with training on how to use the device and will happily answer any questions you might have regarding participating in this study.

Participating in this study will also require you to visit the University of Tasmania up to three times for short study visits. One initial visit to enrol (approximately 45 minutes), and for two short (approximately 15 minutes) visits; the first around day three of participating, and a final visit on day 14 of the study. During the enrolment visit, you will receive training on how to use device and you will be asked to complete some baseline surveys to help us gather background information on your current and previous eating behaviour. At visit 2, three days into the study, the data will be downloaded from your devices and any additional questions you might have will be answered. During the final visit after 14 days, you will return the study device and will receive some debriefing regarding your experiences during the study. You will also be reimbursed $50 for your time and contribution to the research at this visit.

It is important that you understand that your involvement in this study is voluntary. While we would be pleased to have you participate, we respect your right to decline. There will be no consequences to you in you decide not to participate.

All information will be treated highly confidential, and your name or any identifying information will not be used in any publication

arising from this research. All data will be analysed without identifying information so that at no time individual participants can be identified.

The research data will be kept in a locked file cabinet (hard copies) at the School of Medicine, and all electronic data will be kept on a password-protected computer. In accordance with National Ethics Guidelines, hard copy data will be kept for five (5) years before being destroyed. Electronic data will be securely stored until it is no longer needed.

5. Are there any possible benefits from participation in this study?

It is possible that the monitoring technology used in this study will help you learn more about your individual eating and/or drinking behaviour. Furthermore, the information we gather may be beneficial for other people by contributing to the development of future dietary management interventions.

6. Are there any possible risks from participation in this study?

There are no specific risks anticipated with participation in this study.

7. How will the results of the study be published?

When the study has been completed, the main outcomes will be published on the University of Tasmania's website and in scientific journal articles. We will also send you results of the study to the email address you have given us.

Your name will not be used in any publication arising out of the research.

8. What if I have questions about this study?

If you would like to discuss any aspect of this study please feel free to contact our team on (03) 6226 7471. We are happy to discuss any aspect of the research with you. You are welcome to contact us to discuss any issue relating to the research study.

This study has been approved by the Tasmanian Social Sciences Human Research Ethics Committee. If you have concerns or

complaints about the conduct of this study, please contact the Executive Officer of the HREC (Tasmania) Network on (03) 6226 2763 or email human.ethics@utas.edu.au. The Executive Officer is the person nominated to receive complaints from research participants. Please quote ethics reference number H0014439.

Thank you for taking the time to consider this study.

If you wish to take part in it, please sign the attached consent form.

This information sheet is for you to keep.

Appendix E

Consent Form

Private Bag 30 Hobart
Tasmania 7001 Australia
Phone (03) 6226 7471 Fax (03) 6226 7471
Email Benjamin.schuez@utas.edu.au

SCHOOL OF MEDICINE, PSYCHOLOGY

UNIVERSITY OF TASMANIA

CONSENT FORM

Individual and situational predictors of food choices in people with a BMI of 25 and over

1. I acknowledge that the nature, purpose and contemplated effects of the project so far as it affects me, have been fully explained to my satisfaction by the study staff member and my consent is given voluntarily.
2. The details of the research have also been explained to me, including the anticipated length of time it will take, the frequency with which the assessments will be performed. I understand that my participation involves:

    - Fourteen (14) days of monitoring (explained below). While in the study, I will be asked to monitor, record and photograph my eating and drinking behaviour and associated questions using a hand-held computer. I understand that my participation involves carrying this device with me at all times for the duration of the 14 day study.
    - Three study visits to the University of Tasmania campus, each of which will take between 15 and 45 minutes to complete;
    - The completion of a baseline questionnaire (assessing current diet, demographics, and mood questionnaires) during the initial visit.
    - Being reimbursed $50 upon completion of the third visit and return of device to compensate for my time.

3. I understand that there are no risks anticipated from my involvement in this research.

4. I understand that my involvement in the project will not affect my relationship with my medical advisers in their management of my health. I also understand that I am free to withdraw from the project at any stage and any of my data and photographs that have been collected will be withdrawn. My withdrawal will not affect my legal

rights, my medical care or my relationship with the hospital or my doctors.

5. I understand that I will be given a signed copy of the participant information sheet and consent form. I am not giving up my legal rights by signing this consent form.

6. I understand that all research data will be securely stored on the University of Tasmania premises for at least five years and will be destroyed when no longer needed.

7. I understand that research data gathered from me may be published, provided that I cannot be identified as a person.

8. I understand that the researchers will maintain my identity confidential and that any information I supply to the researchers will be used only for the purposes of this research.

9. I understand that the research will be conducted in accordance with the latest versions of the *National Statement on Ethical Conduct in Human Research 2007* and applicable privacy laws.

10. Any questions that I have asked have been answered to my satisfaction.

Name of participant

Email address (if we need to contact you):

Signature of participant

Date

I have explained this project and the implications of participation in it to this volunteer and I believe that the consent is informed and that he/she understands the implications of participation.

Name of investigator

Signature of investigator

Date

Appendix F

EMA Program Questions

Questionnaire: Wakeup Report

Q#	Type of Data	Text	Response type	Response options
1	Question	Good Morning! How long ago did you wake up?	Push Button (pick one)	<15 mins, 15 - 30 mins, 30 - 60 mins, >60 mins
	Instruction	The following questions refer to events occurring since the last morning report:		
2	Question	Have you consumed any meals but NOT yet entered? If yes, how many?	Spinner	0-10+
3	Question	Have you consumed any snacks but NOT yet entered? If yes, how many?	Spinner	0-10+
4	Question	Have you consumed any drinks but NOT yet entered? If yes, how many?	Spinner	0-10+
5	Question	Do you currently crave food?	Slider	0-100 (with No!!-Yes!! anchors)

Main Menu: Food Log

Q#	Type of Data	Text	Response type	Response options	Notes / Skip Patterns
0	GPS				GPS location of participants at time of log start
0	Photo				Participants take photograph of their food
2	Question	Consumed a drink with your meal?	Push Button (pick one)	Yes, No	
3	Question	What type of drink	Check Box (all that apply)	Coffee, Tea, Milk, Alcohol, Energy drink, Normal soft drink / fizzy drink, Calorie-reduced soft drink / fizzy drink, juice, water, other	Ask only if 5e=yes
4	Question	How many drinks in last 15 minutes?	Spinner	1-5+	Ask only if 6e=drinking alcohol
5	Question	Do you feel intoxicated/drunk?	Slider	0-100 (with No!!-Yes!! anchors)	Ask only if 6e=drinking alcohol
	Instruction	Remaining items refer to the situation where you first decided to eat			
	Header	FEELING:			
6	Question	Alert?	Slider	0-100 (with No!!-Yes!! anchors)	
7	Question	Angry/frustrated?	Slider	0-100 (with No!!-Yes!! anchors)	
8	Question	Bored?	Slider	0-100 (with No!!-Yes!! anchors)	
9	Question	Calm/relaxed?	Slider	0-100 (with No!!-Yes!! anchors)	
10	Question	Able to focus?	Slider	0-100 (with No!!-Yes!! anchors)	
11	Question	Happy?	Slider	0-100 (with No!!-Yes!! anchors)	

12	Question	Irritable?	Slider	0-100 (with No!!-Yes!! anchors)	
13	Question	Stressed?	Slider	0-100 (with No!!-Yes!! anchors)	
14	Question	Restless?	Slider	0-100 (with No!!-Yes!! anchors)	
15	Question	Sad?	Slider	0-100 (with No!!-Yes!! anchors)	
16	Question	Energy level?	Push Button (pick one)	Very low, Low, Moderate, High, Very high	
17	Question	Overall feeling?	Push Button (pick one)	Very bad, Bad, Neutral, Good, Very good	
	Header	WHEN YOU DECIDED TO EAT:			
18	Question	Location?	Push Button (pick one)	Home, Workplace, Other's home, Bar, Restaurant, Vehicle, Outside, Between Places, Other	
19	Question	Food available?	Check Box (all that apply, but see note)	None, Confectionary, Savoury, Dairy, Biscuits/cakes/pastries, Fast food, Other	Don’t allow No + any other option
20	Question	From where you are NOW, can you walk in 5 min or see…	Check Box (all that apply, but see note)	1. Franchised Fast Food (Macca, Hungry Jack’s, Subway,…) 2. Other Fast Food (Takeaway, Fish & Chips, …) 3. Sit-down Restaurant 4. Supermarket (Coles, Woolworths, …) 5. Smaller food Shop (Hill Street, fresco, …) 6. Convenience Store 7. Specialty Food Shop (Baker, Butcher, Ethnic Food, …) 8. Chemist or Bargain Shop	Don't allow Alone + any other option

21	Question	With others?	Check Box (all that apply, but see note)	Alone, Friends, Acquaintances, Family members, Co-workers, Romantic partner	Don't allow Alone + any other option
22	Question	People eating?	Check Box (all that apply, but see note)	No, In my group, In view	Don't allow No + any other option
23	Question	Activities?	Check Box (all that apply)	Working/chores, Inactive/leisure, Interacting with others, Between activities, Other activities	
24	Question	Type of work?	Push Button (pick one)	Job, School, House/Personal, Other	Ask only if 25e=Working/chores
25	Question	Type of inactivity/leisure?	Push Button (pick one)	Media, Hanging out, Hobbies, Sports/Exercise, Reading, Waiting, Doing nothing, Other	Ask only if 25e=inactivity/leisure
26	Question	Type of interaction with others?	Push Button (pick one)	Socializing, For business, Household issues, Arguing, Other interaction	Ask only if 25e=interacting with others

Main Menu: Drink log

Q#	Type of Data	Text	Response type	Response options	Notes / Skip Patterns
0	GPS				GPS location of participant at log start
1	Question	Drink	Push Button (pick one)	Coffee, Tea, Milk, Alcohol, Energy drink, Normal soft drink / fizzy drink, Calorie-reduced soft drink / fizzy drink, juice, water, other	*ONLY proceed to rest of questions if report drink with high energy content (i.e. if report caffeine/alcohol/energy drink)
	Header	ABOUT THIS DRINK EPISODE:			
2	Question	How many standard drinks?	Spinner	0-10+	Ask only if 1e=alcohol
3	Question	Intoxicated/drunk?	Slider	0-100 (with No!!-Yes!! anchors)	Ask only if 1e=alcohol
	Instruction	Remaining items refer to the situation where you first decided to drink			
	Header	FEELING:			
4	Question	Alert?	Slider	0-100 (with No!!-Yes!! anchors)	
5	Question	Angry/frustrated?	Slider	0-100 (with No!!-Yes!! anchors)	
6	Question	Bored?	Slider	0-100 (with No!!-Yes!! anchors)	
7	Question	Calm/relaxed?	Slider	0-100 (with No!!-Yes!! anchors)	
8	Question	Able to focus?	Slider	0-100 (with No!!-Yes!! anchors)	
9	Question	Happy?	Slider	0-100 (with No!!-Yes!! anchors)	
10	Question	Irritable?	Slider	0-100 (with No!!-Yes!! anchors)	

11	Question	Stressed?	Slider	0-100 (with No!!-Yes!! anchors)	
12	Question	Restless?	Slider	0-100 (with No!!-Yes!! anchors)	
13	Question	Sad?	Slider	0-100 (with No!!-Yes!! anchors)	
14	Question	Energy level?	Push Button (pick one)	Very low, Low, Moderate, High, Very high	
15	Question	Overall feeling?	Push Button (pick one)	Very bad, Bad, Neutral, Good, Very good	
	Header	WHEN YOU DECIDED TO DRINK:			
16	Question	Location?	Push Button (pick one)	Home, Workplace, Other's home, Bar, Restaurant, Vehicle, Outside, Other	
17	Question	Food available?	Check Box (all that apply, but see note)	None, Confectionary, Savoury, Dairy, Biscuits/cakes/pastries, Fast food, Other	Don’t allow No + any other option
18	Question	From where you are NOW, can you walk in 5 min or see…	Check Box (all that apply, but see note)	1. Franchised Fast Food (Macca, Hungry Jack’s, Subway,…) 2. Other Fast Food (Takeaway, Fish & Chips, …) 3. Sit-down Restaurant 4. Supermarket (Coles, Woolworths, …) 5. Smaller food Shop (Hill Street, fresco, …) 6. Convenience Store 7. Specialty Food Shop (Baker, Butcher, Ethnic Food, …) 8. Chemist or Bargain Shop	Don't allow Alone + any other option

19	Question	With others?	Check Box (all that apply, but see note)	Alone, Friends, Acquaintances, Family members, Co-workers, Romantic partner	Don't allow Alone + any other option
20	Question	People drinking?	Check Box (all that apply, but see note)	No, In my group, In view	Don’t allow No + any other option
21	Question	Activities?	Check Box (all that apply)	Working/chores, Inactive/leisure, Interacting with others, Between activities, Other activities	
22	Question	Type of work?	Push Button (pick one)	Job, School, House/Personal, Other	Ask only if 20e=Working/chores
23	Question	Type of inactivity/leisure?	Push Button (pick one)	Media, Hanging out, Hobbies, Sports/Exercise, Reading, Waiting, Doing nothing, Other	Ask only if 20e=inactivity/leisure
24	Question	Type of interaction with others?	Push Button (pick one)	Socializing, For business, Household issues, Arguing, Other interaction	Ask only if 20e=interacting with others

Questionnaire: Random Prompts

Q#	Type of Data	Text	Response type	Response options	Notes / Skip Patterns
	Instruction	ABOUT YOUR LAST FOOD/DRINK:			
1	Question	How long ago did the event occur?	Push Button (pick one)	0-10 mins, 10-30mins, 30-60 mins, 1-2hours, 2-3 hours, >3hours	
2	Question	Was the food/drink satisfying?	Slider	0-100 (with No!!-Yes!! anchors)	
3	Question	Was the food/drink enjoyable/pleasing?	Slider	0-100 (with No!!-Yes!! anchors)	
4	Question	How much did you consume?	Push Button (pick one)	More than usual, Same as usual, less than usual	
	Header	RIGHT NOW:			
5	Question	Alert?	Slider	0-100 (with No!!-Yes!! anchors)	
6	Question	Angry/frustrated?	Slider	0-100 (with No!!-Yes!! anchors)	
7	Question	Bored?	Slider	0-100 (with No!!-Yes!! anchors)	
8	Question	Calm/relaxed?	Slider	0-100 (with No!!-Yes!! anchors)	

9	Question	Able to focus?	Slider	0-100 (with No!!-Yes!! anchors)
10	Question	Happy?	Slider	0-100 (with No!!-Yes!! anchors)
11	Question	Irritable?	Slider	0-100 (with No!!-Yes!! anchors)
12	Question	Stressed?	Slider	0-100 (with No!!-Yes!! anchors)
13	Question	Restless?	Slider	0-100 (with No!!-Yes!! anchors)
14	Question	Sad?	Slider	0-100 (with No!!-Yes!! anchors)
15	Question	Energy level?	Push Button (pick one)	Very low, Low, Moderate, High, Very high
16	Question	Overall feeling?	Push Button (pick one)	Very bad, Bad, Neutral, Good, Very good
	Header	RIGHT NOW:		
17	Question	Location?	Push Button (pick one)	Home, Workplace, Other's home, Bar, Restaurant, Vehicle, Outside, Other

18	Question	From where you are NOW, can you walk in 5 min or see…	Check Box (all that apply, but see note)	1. Franchised Fast Food (Macca, Hungry Jack's, Subway,…) 2. Other Fast Food (Takeaway, Fish & Chips, …) 3. Sit-down Restaurant 4. Supermarket (Coles, Woolworths, …) 5. Smaller food Shop (Hill Street, fresco, …) 6. Convenience Store 7. Specialty Food Shop (Baker, Butcher, Ethnic Food, …) 8. Chemist or Bargain Shop	Don't allow Alone + any other option
19	Question	Food available?	Check Box (all that apply, but see note)	Candy Bar, Chocolate, Other Confectionary, Chips, Cheese, Cracker, Fruit/Nuts, Dairy, Biscuits/cakes/pastries, Fast food, Other	Don't allow No + any other option
20	Question	With others?	Check Box (all that apply, but see note)	Alone, Friends, Acquaintances, Family members, Co-workers, Romantic partner	Don't allow Alone + any other option
21	Question	People eating?	Check Box (all that apply, but see note)	No, In my group, In view	Don't allow No + any other option

22	Question	Activities?	Check Box (all that apply)	Working/chores, Inactive/leisure, Interacting with others, Between activities, Other activities	
23	Question	Type of work?	Push Button (pick one)	Job, School, House/Personal, Other	Ask only if 21e=Working/chores
24	Question	Type of inactivity/leisure?	Push Button (pick one)	Media, Hanging out, Hobbies, Sports/Exercise, Reading, Waiting, Doing nothing, Other	Ask only if 21e=inactivity/leisure
25	Question	Type of interaction with others?	Push Button (pick one)	Socializing, For business, Household issues, Arguing, Other interaction	Ask only if 21e=interacting with others
26	Question	Would you like to eat right now but think that you shouldn't?	Slider	0-100 (with No!!-Yes!! anchors)	

Questionnaire: Evening Report

Q#	Type of Data	Text	Response type	Response options
	Instruction	The following questions refer to events occurring since the last morning report:		
1	Question	How many meals consumed today?	Spinner	0-10+
2	Question	How many snacks consumed today?	Spinner	0-10+
3	Question	How many drinks consumed today?	Spinner	0-10+
4	Question	Found yourself craving food at any stage?	Slider	0-100 (with No!!-Yes!! anchors)
5	Question	Was the craving intense?	Slider	0-100 (with No!!-Yes!! anchors)
6	Question	What type of food were you craving?	Push Button (pick one)	Biscuits/cakes/pastries, Fast food, Other
7	Question	Overall feeling	Push Button (pick one)	Very bad, Bad, Neutral, Good, Very good
8	Question	Energy level?	Slider	0-100 (with No!!-Yes!! anchors)
9	Question	Able to control important things?	Slider	0-100 (with No!!-Yes!! anchors)
10	Question	Able to handle personal problems?	Slider	0-100 (with No!!-Yes!! anchors)
11	Question	Nervous / stressed?	Slider	0-100 (with No!!-Yes!! anchors)
12	Question	Things going your way?	Slider	0-100 (with No!!-Yes!! anchors)
13	Question	Unexpected things upset you?	Slider	0-100 (with No!!-Yes!! anchors)
14	Question	Upset by things outside of your control?	Slider	0-100 (with No!!-Yes!! anchors)
15	Question	Meals consumed but NOT yet entered?	Spinner	0-5+

16	Question	Snacks consumed but NOT yet entered?	Spinner	0-10+
17	Question	Drinks consumed but NOT yet entered?	Spinner	0-10+
18	Question	Felt like eating but didn't'?	Slider	0-100 (with No!!-Yes!! anchors)
19	Question	Exercised today?	Push Button (pick one)	No, Yes
20	Question	How long did you exercise for?	Push Button (pick one)	0-10mins, 10-30mins, 30mins-1hour, 1-2hours, 2-3 hours,>3hours